



Effect of the pandemic on surgical procedures in a tertiary care hospital: A retrospective review

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ABSTRACT

Objective: The aim of this study was to examine the impact of performing surgeries with necessary precautions and to evaluate demographic characteristics of operated patients during novel coronavirus-2019 (COVID-19) pandemic and the infection rates during hospitalization and within 14 days after surgery.

Material and Methods: Between March 15th, 2020 and April 30th, 2020, a total of 639 patients who had been operated on in our center were retrospectively analyzed. According to the triage system, the surgical procedures were classified as emergency, time-sensitive, and elective procedures. Data including age, sex, indication for surgery, the American Society of Anesthesiologists (ASA) class, pre- and postoperative symptoms, the presence and/or absence of reverse transcriptase-polymerase chain reaction (RT-PCR) test result, type of surgery, surgical site, and documented COVID-19 infections during hospitalization and within 21 days after surgery were recorded.

Results: Of the patients, 60.4% were males and 39.6% were females with a mean age of 43.08 ± 22.68 years. Malignancy was the most common indication for surgery (35.5%), followed by trauma (29.1%). The abdominal area and head and neck region were the most frequent surgical sites in 27.4% and 24.9% of the patients, respectively. Of all surgical procedures, 54.9% were emergency and 43.9% were time-sensitive procedures. Of the patients, 84.2% were in ASA Class I-II while 15.8% patients were in ASA Class III, IV and V. General anesthesia was the most common anesthesia type in 83.9% of the patients. The overall rate of COVID-19 infection was 0.63% in the preoperative period. The rate of COVID-19 infection during and after surgery was 0.31%.

Conclusion: With similar infection rates to the general population, surgeries of all types can be performed safely taking preventive measures in the pre- and postoperative period. It would be wise to perform surgical treatment without delay in patients with an increased risk for mortality and morbidity in accordance with strict infection control principles.

Keywords: COVID-19, operative surgical procedure, demographic

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INTRODUCTION

Pneumonia cases of unknown etiology were first reported in Wuhan, Hubei province of China in December 2019 and rapidly spread all over the world (1). The virus was identified as severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2), which was later named as novel coronavirus-2019 (COVID-19). The World Health Organization (WHO) declared COVID-19 a pandemic on March 11th, 2020 with a public health emergency of international concern (2).

The COVID-19 pandemic has dramatically affected healthcare services in many ways worldwide, and there is an increased need for intensive care unit (ICU) beds and workforce. With the increasing number of infected patients requiring hospitalization, the working practices has dramatically changed, and non-urgent elective surgeries and procedures have been postponed in many centers in accordance with the Republic of Türkiye, Ministry of Health. From the beginning of the pan-

demic, surgical workforce has had to adopt new working practices to schedule both elective and emergency surgeries in a timely manner to utilize medical equipment and consumables, bed capacity, and workforce in the most effective way (3-7). Necessary measures have been implemented to minimize the risk of transmission in operating rooms, patient wards, and the other settings such as hallways, elevators, and stairs (8-10).

The impact of postponing elective surgeries during the pandemic has not yet been clearly understood; however, operation-related stress has been proposed to disrupt the immune system, making patients more vulnerable to infections and the decision-making process becomes more difficult, as the symptoms of the patient can overlap with potential COVID-19 infection (11). Nevertheless, emergency operations are time-sensitive and require prompt decisions. In previous studies, delayed treatment in cancer patients has been associated with adverse outcomes with reduced cure rates (12,13). In emergency operations, therefore, there is a consensus among surgeons that surgery should be planned without delay taking necessary precautions.

In the present study, it was aimed to examine the impact of performing surgeries with necessary precautions and to evaluate demographic characteristics of operated patients during the COVID-19 pandemic and the infection rates during hospitalization and within 14 days after surgery.

MATERIAL and METHODS

This single-center, retrospective study was conducted at the Department of General Surgery, Neurosurgery, Aesthetic, Plastic and Reconstructive Surgery, Thoracic Surgery, Orthopedics and Traumatology, Urology, Ophthalmology, and Otorhinolaryngology of Marmara University, Pendik Training and Research Hospital, İstanbul, between March 15th, 2020 and April 30th, 2020. Prior to surgery, all patients were informed about the possible risks and benefits of surgery, and a written informed consent was obtained. The study protocol was approved by Marmara University, School of Medicine, Ethics Committee with the approval no: 09.2020.706. The study was conducted in accordance with the principles of the Declaration of Helsinki.

A total of 639 patients who had been operated on in our center between the study period were included. Data including age, sex, indication for surgery, the American Society of Anesthesiologists (ASA) class, pre- and postoperative fever, dry cough, the presence and/or absence of reverse transcriptase-polymerase chain reaction (RT-PCR) testing, type of surgery (elective vs. emergency), surgical site, and documented COVID-19 infections during hospitalization and within 21 days after surgery were recorded. According to the triage system, surgical procedures were classified as follows: emergency procedures (a delay beyond four weeks would result in an increased risk of morbidity and mortality), time-sensitive procedures (a delay beyond four

weeks to three months would result in an increased risk of morbidity and mortality), and elective procedures (deferrable for up to >3 months). Triage of the patients was carried out by the surgical departments included in the study in accordance with the national and international guideline recommendations. All healthcare workers complied with the donning/doffing procedures of personal protective equipment (PPE), including face mask, gloves, goggles, and face shields.

During the pandemic, cardiovascular surgeries were referred to an external center and obstetrics and gynecology procedures were carried out in a private center; therefore, these departments were excluded from the study.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean \pm standard deviation (SD), median (min-max) or number and frequency, where applicable. Pairwise comparisons were performed using the non-parametric Mann-Whitney U test while the Kruskal-Wallis H test was used for multiple comparisons. A p value of <0.05 was considered statistically significant.

RESULTS

Of a total of 639 patients included in this study, 60.4% were males and 39.6% were females with a mean age of 43.08 ± 22.68 (range, 0 to 97) years. Malignancy was the most common indication for surgery (35.5%), followed by trauma (29.1%). The abdominal area and head and neck region were the most frequent surgical sites in 27.4% and 24.9% of the patients, respectively. Of all surgical procedures, 54.9% were emergency and 43.9% were time-sensitive procedures. Of the patients, 84.2% were in ASA Class I-II while 15.8% patients were in ASA class III, IV and V. General anesthesia was the most common anesthesia type in 83.9% of the patients. Demographic and clinical characteristics of the patients and operative data are summarized in Table 1.

Of the 68 (10.6%) patients who needed ICU stay, 26.5% (n= 18) were operated from the head and neck region, 26.5% (n= 18) from the abdominal area, and 23.5% (n= 16) from the lower extremities. Majority of these patients were in ASA class I (33.8%) and class II (50%) and were operated under general anesthesia (85.4%). More than half of these patients (54.4%) were males.

In the preoperative period, four patients had fever and two patients had dry cough and underwent RT-PCR test. Of these patients, four tested SARS-CoV-2-positive. The overall rate of COVID-19 infection was 0.63% in the preoperative period. In addition, 4.4% (n= 28) of the patients including 2.5% (n= 16) with fever and 0.9% (n= 6) with dry cough in the postoperative period underwent RT-PCR test, and two patients tested SARS-CoV-2-positive. The rate of COVID-19 infection during and after surgery up to 21 days was 0.31% (n= 2). Demographic character-

Table 1. Demographic and clinical characteristics of the patients and operative data

		Male n (%)	Female n (%)	Total n (%)	p
Indication for surgery	Malignancy	122 (53.7)	105 (46.3)	227 (35.5)	0.032*
	Trauma	118 (63.4)	68 (36.6)	186 (29.1)	
	Acute abdomen	26 (60.5)	17 (39.5)	43 (6.7)	
	Diabetic foot	10 (90.9)	1 (9.1)	11 (1.7)	
	Urinary stone	22 (75.9)	7 (24.1)	29 (4.5)	
	Other	88 (61.5)	55 (38.5)	143 (22.4)	
Surgical site	Head-neck	92 (57.9)	67 (42.1)	159 (25)	0.904
	Thorax	46 (64.8)	25 (35.2)	71 (11.19)	
	Abdomen	107 (61.1)	68 (38.9)	175 (27.5)	
	Upper extremities	49 (62)	30 (38)	79 (12.4)	
	Lower extremities	74 (58.3)	53 (41.7)	127 (19.9)	
	Two sites	16 (64)	9 (36)	25 (3.9)	
	Three sites	1 (100)	0	1 (0.2)	
ASA Class	I	166 (60.4)	109 (39.6)	275 (43.1)	0.843
	II	157 (59.9)	105 (40.1)	262 (41.1)	
	III	55 (64.7)	30 (35.3)	85 (13.3)	
	IV	7 (50)	7 (50)	14 (2.2)	
	V	1 (50)	1 (50)	2 (0.3)	
Anesthesia type	General	320 (59.7)	216 (40.3)	536 (83.9)	0.904
	Regional	48 (62.3)	29 (37.7)	77 (12.1)	
	Local infiltration	12 (66.7)	6 (33.3)	18 (2.8)	
	Sedoanalgesia	6 (75)	2 (25)	8 (1.3)	
Triage category	Emergency	207 (59.1)	143 (40.9)	350 (54.9)	0.587
	Time-sensitive	172 (61.4)	108 (38.6)	280 (43.9)	
	Elective	6 (75)	2 (25)	8 (1.3)	
ICU need		37 (54.4)	31 (45.6)	68 (10.6)	0.348
Total		386 (60.4)	253 (39.6)	639 (100)	

*p at <0.05 indicates statistical significance. ASA: American Society of Anesthesiologists; ICU: Intensive care unit.

Table 2. Demographic characteristics and operative data of COVID-19-positive patients both in the pre- and postoperative period

	N	Age	Sex	ASA Class		Surgical site		Length of stay	ICU need
	n	Year (Mean)	F/M	Class	n		n	Day	n
Preoperative PCR (+)	4	73	3/1	III IV	1 3	Thorax Abdomen	3 1	5.5	1
Postoperative PCR (+)	2	46	0/2	II III	1 1	Thorax	2	11	None

ASA: American Society of Anesthesiologists; ICU: Intensive care unit.

istics and operative data of the COVID-19-positive patients both in the pre- and postoperative period are shown in Tables 2 and 3. Mean ages of the patients who were scheduled for emergency surgery, time-sensitive surgery, and elective surgery were

41.08 ± 22.99 years, 45.31 ± 22.03 years, and 51.13 ± 26.07 years, respectively, indicating no statistically significant difference (p= 0.599). Surgery triage according to the age of the patients is presented in Table 4.

Table 3. Pre- and postoperative COVID-19 symptoms

	ICU Stay	PREOP Fever	PREOP Cough	PREOP PCR Test	POSTOP Fever	POSTOP Cough	POSTOP PCR Test
Yes	68	4	2	15 (4 positive)	16	6	28 (2 positive)
No	571	635	637	624	623	633	611

ICU: Intensive care unit; PREOP: Preoperative; POSTOP: Postoperative; PCR: Polymerase chain reaction.

Table 4. Surgery triage according to the age of the patients

Age		Emergency	Time-sensitive	Elective	Total	p
0-10 years	n	48	21	0	69	0.182
	%	13.7%	7.5%	.0%	10.8%	
11-20 years	n	28	18	1	47	
	%	8.0%	6.4%	12.5%	7.4%	
21-30 years	n	40	42	2	84	
	%	11.4%	15.0%	25.0%	13.2%	
31-40 years	n	54	38	0	92	
	%	15.4%	13.6%	.0%	14.4%	
41-50 years	n	46	34	1	81	
	%	13.1%	12.1%	12.5%	12.7%	
51-60 years	n	57	40	0	97	
	%	16.3%	14.3%	.0%	15.2%	
61-70 years	n	44	50	2	96	
	%	12.6%	17.9%	25.0%	15.0%	
71-80 years	n	19	28	1	48	
	%	5.4%	10.0%	12.5%	7.5%	
81-90 years	n	13	8	1	22	
	%	3.7%	2.9%	12.5%	3.4%	
>90 years	n	1	1	0	2	
	%	.3%	.4%	.0%	.3%	
Total		350	280	8	638	

Data are given in number and frequency, unless otherwise stated. p at <0.05 indicates statistical significance.

DISCUSSION

The COVID-19 pandemic has swept through the world, placing an enormous strain on many aspects of life, including social life, work, school, and family. The rapid spread of the pandemic has mainly crippled healthcare services, and elective surgeries have been postponed to allow facilities to dedicate all available healthcare resources, including healthcare workers and equipment, to the treatment of infected patients and to protect patients from being infected with the deadly virus, which is also the subject of ethics and medicolegal problems. In a study, Di Martino et al. (14) have reported the rate of COVID-19 infection after surgery as 7% among the operated patients during the pandemic while Karayiannis et al. (19) have found this rate to be 5.6%. In our study, the rate of COVID-19 infection as confirmed by RT-PCR was quite lower than the previous studies

and general population (n= 2, 0.31%) within 21 days of surgery. In addition, we observed no COVID-19-related mortality in our study while Karayiannis et al. (15) have reported the mortality rate from COVID-19 as 0.8%.

In a large-scale, multi-center, cohort study, operated patients with COVID-19 infection diagnosed within seven days before or 30 days after surgery have been evaluated (16). In that study, mortality rate has been found as 23.8% in these patients and male sex, ≥ 70 years of age, ASA class III-V, cancer surgery, and emergency surgery have been found to increase mortality rates. In a systematic review and meta-analysis, Wang et al. (17) have reported that COVID-19-positive patients with hip fractures scheduled for surgery had ≥ 5 times higher risks of early mortality than COVID-19-negative patients with hip fractures. In the current study, six patients who tested COVID-19 positive

in the pre- or postoperative period needed ICU stay; however, none of the patients died. Of note, these patients were in ASA Class IV, leading to an increased rate of morbidity.

In our country, all elective surgical procedures were postponed or cancelled to prevent devastating consequences of the pandemic in accordance with the Republic of Türkiye, Ministry of Health guidelines, resulting in a rapid decline in the number of surgeries (18). Initially, healthcare workers and facilities faced many unknowns and confusion regarding the prioritization of cases for emergency and elective. Later, however, the societies of each specialty issued relevant guidelines (19). In our study, surgical procedures were classified based on the triage system as emergency, time-sensitive, and elective procedures. According to the guidelines and general medical practice in pandemics, epidemics, and outbreaks, emergency surgeries are prioritized. In the present study, majority of the patients (54.9%) underwent emergency operations. Although therapeutic modifications for emergency cases were recommended, emergency procedures were performed, when indicated. Altogether, the COVID-19 pandemic forced surgeons to reschedule elective surgeries and adopt a “new normal” work schedule in order to minimize the time spent in the hospital setting and to protect patients from being infected (20). In our study, the rate of elective surgical procedures was only 1.3%, and these patients were operated within the first week of pandemic and elective procedures were postponed during the ongoing pandemic.

Timing of time-sensitive surgical procedures are still controversial. During the pandemic, hospital administrators and healthcare providers have faced certain challenges on how to utilize critical resources most effectively (i.e., hospital and ICU beds, mechanical ventilators, PPE, and blood transfusion capacity), which are all of utmost importance to protect healthcare workers and patients from viral exposure and to minimize in-hospital transmission of COVID-19. Among those scheduled for time-sensitive surgical procedures, a considerable rate of the patients (43.9%) was operated in our study. According to the triage system, time-sensitive procedures were defined as procedures which could be slightly delayed, but not beyond three months; otherwise, such a delay could result in worsening morbidity and mortality for the patient. In this group of patients, the majority of them (35.5%) were operated for malignant diseases. In particular, immunosuppressed patients, such as cancer patients, are at a higher risk for more severe forms of COVID-19 and, therefore, hospital admission of these patients should be minimized as much as possible. In our country, telemedicine technology has been in use to protect patients from being infected and to utilize healthcare resources in the most optimal way. However, time-sensitive and emergency, invasive procedures that need to be done in the operating room setting have been performed to avoid adverse consequences. Surgeons

discuss the possible risk of infection with their patients and decide to treat or delay the existing pathology. In the literature, psychological distress has been reported in cancer (21) and epileptic patients (22), compared to healthy individuals, due to serious concerns about their cancelled and/or postponed surgeries. It has been well established that stress reduces the ability of the immune system to fight against infections and such a psychological stress may lead to increase the infection rates and disease progression in these patients. In a study, Rivera et al. (23) have reported that the all-cause mortality rate among cancer patients infected with COVID-19 was significantly higher than the general population (17% vs. 2-7%, respectively). In our study, however, none of the patients with cancer tested COVID-19-positive. Consistent with our results, in another study conducted by Ji et al. (24) to investigate the incidence of COVID-19 in patients undergoing elective cancer surgery, a total of 621 elective cancer surgeries from different specialties have been examined, and none of the patients has been found COVID-19-positive after surgery as confirmed by RT-PCR test during minimum 30-day follow-up period. Although this finding cannot be fully explained, one of the reasons may be the fact that the first case of COVID-19 in Türkiye was identified after a couple of weeks and months than many European, Middle East, and Far East countries, and prompt measures were taken after the first case in accordance with the global precautions and strategic plans for the pandemic. Additionally, high-risk cancer patients themselves or their relatives may have refrained from consulting a physician and being operated to avoid infection. Finally, as ICU beds have been mostly occupied by COVID-19 patients in many facilities during the pandemic, surgical treatments may have been abandoned or the patients may have been referred to an external center with available ICU beds. In our study, two patients in the time-sensitive category with COVID-19 positivity were operated for tracheal stenosis (n= 1) and sarcoidosis (n= 1). None of the patients undergoing emergency or elective surgery had COVID-19 infection.

During the pandemic, necessary measures were implemented in our facility to minimize the risk of transmission in operating rooms, patient wards, hallways, elevators, and stairs. All healthcare staff were instructed to wear PPE. The patients undergoing surgery were taken to single-patient wards, and caregivers and/or companions or visitors were not allowed. In addition, flexible working arrangements enabled surgeons of all specialties to do the same amount of work over a different period.

Nonetheless, there are some limitations to this study. First, mortality and morbidity rates were unable to be evaluated due to the relatively low number of patients with COVID-19 infection postoperatively. Second, asymptomatic cases may have been missed due to lack of RT-PCR screening from nasopharynx.

ryngeal swabs on a regular basis. Third, besides patients, front-line healthcare workers are also at a high risk of infection. In our study, healthcare workers who collected nasopharyngeal swabs from six COVID-19-positive patients did not undergo RT-PCR testing to confirm the presence or absence of the infection. Further studies investigating differences in the demographic characteristics of the patients operated on during the pandemic compared to the previous year would provide additional information on this topic.

CONCLUSION

In conclusion, with similar infection rates to the general population, surgeries of all types (i.e., emergency or elective cancer surgery) can be performed safely taking preventive measures in the pre- and postoperative period. It would be wise to perform surgical treatment without delay in patients with an increased risk for mortality and morbidity in accordance with strict infection control principles. Further studies are needed to elucidate the true incidence of COVID-19 infection in frontline healthcare workers.

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COVID-19 pandemisinin üçüncü basamak sağlık kuruluşunda gerçekleştirilen cerrahi girişimlere etkisi

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ÖZET

Giriş ve Amaç: Bu çalışmanın amacı, yeni koronavirüs-2019 (COVID-19) pandemisi sürerken gerekli önlemleri alarak cerrahi operasyonları yürütmenin etkisini incelemek, cerrahi operasyon geçirmiş hastaların demografik özelliklerini ve hastaneye yatış esnasında ve operasyondan sonraki 14 gün içinde karşımıza çıkan enfeksiyon oranlarını değerlendirmektir.

Gereç ve Yöntem: Merkezimizde 15 Mart ve 30 Nisan 2020 tarihleri arasında ameliyat edilmiş toplam 639 hasta retrospektif olarak analiz edildi. Triyaj sistemine göre ameliyatlar acil, zamana duyarlı ve elektif olarak sınıflandırıldı. Yaş, cinsiyet, ameliyat endikasyonu, Amerikan Anestezistler Derneği (ASA) sınıflandırması, pre ve postoperatif semptomlar, ters transkriptaz polimeraz zincir reaksiyonu (RT-PCR) test sonucunun olup olmaması, cerrahi operasyon türü, cerrahi alan ve hastaneye yatış ile operasyon sonrası 21 gün içerisinde belgelenmiş COVID-19 enfeksiyonu hakkındaki veriler kayıt altına alındı.

Bulgular: Hastalardan %60,4'ü erkek, %39,6'sı kadın ve ortalama yaşları $43,08 \pm 22,68$ yıl idi. Malignite en yaygın ameliyat endikasyonu (%35,5) olmakla birlikte bunu travma (%29,1) takip etti. Hastaların sırasıyla %27,4'ünde ve %24,9'unda en sık karşılaşılan cerrahi alanlar abdominal bölge ve baş-boyun bölgesiydi. Tüm cerrahi operasyonların içerisinde %54,9'u acil ve %43,9'u zamana duyarlı operasyonlardı. Hastalardan %84,2'si ASA I-II sınıflandırmasındayken %15,8'i ASA III, IV ve V sınıflandırmasındaydı. Yüzde 83,9'luk bir oranla en yaygın anestezi türü genel anesteziydi. Preoperatif dönemde COVID-19 enfeksiyonu oranı %0,63 idi. Cerrahi operasyon esnasında ve sonrasında COVID-19 enfeksiyonu oranı ise %0,31 idi.

Sonuç: Genel popülasyona benzer enfeksiyon oranları ile her tür cerrahi operasyon preoperatif ve postoperatif dönemde gerekli önlemler alınarak güvenli bir şekilde uygulanabilir. Katı enfeksiyon kontrol ilkelerine uyarak mortalite ve morbidite riskinin yüksek olduğu hastalarda geç kalınmadan cerrahi tedavinin uygulanması akıllıca olacaktır.

Anahtar Kelimeler: COVID-19, cerrahi operasyon, demografik

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